Dr. Schlichter rightly takes the Rhapta of Ptolemy and his Periplus as the central point of his calculations. Besides Rhapta, Ptolemy mentions a promontory called Rhaptum, and a river called Rhaptus. The "metropolis of Rhapta" must have been somewhat inland, but Dr. Schlichter has no difficulty in identifying the Pangani River with the Rhaptus, and Ras Mamba Mku, a cape to the south of Zanzibar as Ptolemy's Rhaptum. Taking this as his starting-point, and making due allowance for Ptolemy's mistakes as to the length of the degree, Dr. Schlichter measures off with his compasses the distances given by Ptolemy, and in this way identifies most of the places in East Central Africa mentioned by Ptolemy with well-known places of the present day. He measures off, for the sake of minute accuracy, his distances in millimetres. He has constructed two maps—one based merely on Ptolemaic data and another showing the latest knowledge: the coincidences are striking. In this way Dr. Schlichter identified the coast places marked by Ptolemy with such well-known places as Melinda, the mouth of the Tana, the towns of Brava, Marka, Magdishu, Warsheikh, and other places. Applying the same method to the positions in the interior given by Ptolemy, Dr. Schlichter identifies Ptolemy's Eastern Nile Lake with the Victoria Nyanza; the circle, with Rhaptum as the centre and the position given by Ptolemy in the interior as the other end of the radius, cuts the south-east shore of Victoria Nyanza. Following the same method, Dr. Schlichter finds that the position given by Ptolemy for the eastern end of the Mountains of the Moon coincides with a point a little to the south of Mount Kenia. Again, in a similar manner he identifies the Western Nile Lake with Lake Albert or Lake Albert Edward, the western end of the Mountains of the Moon with Ruwenzori, and the confluence of the two rivers which form the Nile with the place where the Somerset Nile flows into Lake Albert.

These instances are sufficient to indicate the method followed by Dr. Schlichter, and its success in identifying the positions given by Ptolemy with features which we know now really do exist. In the subsequent discussion, Mr. Ravenstein endeavoured to prove that Dr. Schlichter's method was entirely misleading, even although he admitted that the position adopted for Rhaptum was approximately correct. Mr. Ravenstein's arguments cannot, however, be regarded as convincing; and although we are not interested in upholding Dr. Schlichter's position, still we think that, in justice to Ptolemy, and in the interests of historical truth, his methods and results deserve serious consideration.

CARL JOHANN MAXIMOWICZ.

CARL JOHANN MAXIMOWICZ, who died at St. Petersburg on February 16, after a few days' illness, was born at Tula in 1827. He went early to St. Petersburg, where he was brought up at the St. Annenschule, a renowned German Lutheran College. In 1844 he left the Russian capital for the University of Dorpat. After completing his studies, he was appointed director's assistant at the botanical garden of Dorpat, a post he held until 1852, when he was made Conservator of the Imperial Botanical Garden at St. Petersburg. The following year he set out on a voyage around the world on board the frigate *Diana*, his chief task being to make acquisitions of living plants for the botanical garden at St. Petersburg. The *Diana* visited Rio de Janeiro, Valparaiso, and Honolulu. But when war was declared by the Western Powers against Russia, she was compelled to call at the nearest Russian harbour, De Castries, on the coast of Mantchuria, at that time the youngest, and scarcely an organized, Russian colony. Maximowicz had to leave the frigate, and decided at once to go up the River Amur, and to explore its banks and the adjoining country, which was then little known. Though furnished with only limited means, he carried out his task under great difficulties and severe privations in a very successful manner. He returned to St. Petersburg by way of Siberia in 1857. The next two years he devoted entirely to the working out of his "Primitiæ Floræ Amurensis: Versuch einer Flora des Amurlandes," a thick quarto volume, which appeared in 1859, and contained a full enumeration of his botanical collections, and a most clear exposition of the general physical features of the country visited by him, and particularly of its phytogeographical character. Immediately after, the full Demidoff Prize was awarded to him in acknowledgment of the excellence of his work. At the same time he was directed to proceed again to the far East. In 1859 and 1860 he travelled in Mantchuria; in 1861 he visited the island of Yesso; 1862, Nipon; 1863, Kiu-siu. He returned to Europe by the sea-route in 1864. It was then that he first visited England. He was at that time in a bad state of health, in consequence of an obstinate fever he caught in Japan, and from the effects of which he suffered from time to time throughout his life. In 1869 he was appointed Botanicus Primarius at the Imperial Botanical Garden at St. Petersburg, and he was a Fellow of the Imperial Academy of Science from 1864. Consequently he was also entrusted with the direction of the Herbarium of the Academy. After 1866 he published many contributions to the flora of Eastern Asia in the *Mémoires* and the *Bulletins* of the Academy, the most important being a monograph of the rhododendrons of Eastern Asia, the "Diagnoses breves Plantarum Novarum Japoniæ et Mandshuriæ, Dec. i.–xx."; the "Diagnoses Plantarum Novarum Asiaticarum, i.–vii.," &c. It was in the latter that he began to work out the large and exceedingly important collections made by Prjevalsky, Potanin, &c., in Central Asia. In consequence, however, of the extreme thoroughness of his work, and his highly critical method, combined with overwhelming official duties, the first parts of these important works did not appear before the end of 1889. These are the "Flora Tangutica" and the "Enumeratio Plantarum hucusque in Mongolia, &c., Lectarum," each comprising only the Thalamifloræ and the Disciforæ of the collections. A general review of the phytogeography of Central Asia, founded on the collections of Prjevalsky and other Russian explorers, however, was submitted by him to the Botanical and Horticultural Congress at St. Petersburg, 1884; it is a model of lucidity of style and arrangement. Now, we fear, these two works, so comprehensively planned, will proceed no further, although Maximowicz's preparations for the remaining parts were considerably advanced and a large number of most beautiful plates are ready for press. But we look in vain for the man in Russia who could take up the work. Russia was so unfortunate as to lose her great explorer by sudden death at the very moment when he was setting out to gather new laurels, and now his most famous interpreter has breathed his last not less unexpectedly. Deeply as we must regret that he was not permitted to finish his work himself, one thing is certain—that whatever he completed will last. He was of a noble, high-minded nature, a highly cultivated scholar in almost every branch of learning, and a gentleman in the truest sense of the word.

OTTO STAPF.

NOTES.

THE next ordinary general meeting of the Institution of Mechanical Engineers will be held on Thursday evening, the 19th, and Friday evening, the 20th, at 25 Great George Street, Westminster. The chair will be taken by the President, Mr. Joseph Tomlinson, at half-past seven p.m. on each evening. The following papers will be read and discussed, as far as time permits :—Fourth report of the Research Committee on Friction : experiments on the friction of a pivot-bearing. On recent trials of rock drills, by Mr. Edward H. Carbutt, past-President, and Mr. Henry Davey, of London.

THE annual general meeting of the Linnean Society of New South Wales was held on January 28. Dr. J. C. Cox, Vice-President, delivered the annual address. Pointing out that Australia offered an unrivalled opportunity of working up completely, and under the most favourable circumstances, the flora and fauna, especially interesting in itself, of one of the great tracts of the globe, he inquired how it was that with such a splendid harvest still waiting to be gathered in spite of all that had been accomplished, the number of workers was relatively so few. He attributed the slow increase in the number of enthusiastic naturalists partly to defective educational methods which left children blind to the beauties and attractions of Nature ; partly to the want of descriptive catalogues, and well-illustrated hand-books, written from the Australian stand-point ; and partly to the very slender inducement to young men in Australia to qualify themselves for the serious pursuit of science.

AT Oxford, on Tuesday, Convocation voted the sum of £150 per annum for three years for a scholarship to be held by a student in the Marine Biological Institute at Naples.

THE General Board of Studies at Cambridge has recommended the appointment of a Demonstrator in Palæobotany in the department of geology.

LAST week Mr. Leon Warnerke delivered before the Photographic Society of Great Britain a lecture on a simplified photo-collographic process. Instead of a glass or metal plate, as is usual in the collotype process, Mr. Warnerke makes use of a gelatine film supported upon vegetable parchment. He demonstrated the method of sensitizing and drying the film, explained the process of printing, and passed round specimens for inspection before and after printing and after washing with water. He then demonstrated the method of printing, and showed its application to wood engraving, to canvas, and to the decoration of china and porcelain. The walls of the room were hung with between two and three hundred examples of collotype printing sent for exhibition by the Autotype Company, the London Stereoscopic Company, and Messrs. Bemrose and Sons, of Derby, Waterlow and Sons, Römmler and Jonas, of Dresden, L. Rouillé, of Paris, F. Thevoy and Co., of Geneva. It was announced that the exhibition would remain open for a month.

THE first electrical launch ever built for the English Government was sent off the stocks into the Thames at Messrs. Woodhouse and Rawson's yard, near Kew Bridge Station, on Tuesday afternoon. The *Electric*, as the pinnace is called, is to be used for the conveyance of troops between the dockyards of Chatham and Sheerness. The *Daily News* describes the motion of the boat as "delightfully smooth—the very poetry of motion." With her forty fully-equipped soldiers, she can run at a speed of eight knots an hour. A single charge of electricity enables her to run for ten hours.

As various erroneous statements have been made with regard to Dr. Nansen's Arctic expedition, the *Times* gives the following account of what has actually been arranged. Dr. Nansen's desire is to leave Norway in February 1892, but it is doubtful whether the special vessel which is being built will be ready by that time. Outside of Norway not a farthing has been contributed by anyone. The expedition is purely Norwegian, and will remain so. The Norwegian Government contribute 200,000 kroner ; King Oscar, 20,000 ; twelve private individuals (all Norwegians except one Englishman who has lived in Christiania for many years), 90,000 : in all, 310,000 kroner, equal to £17,200. That, Dr. Nansen believes, will be sufficient. The ship, of course, is being specially constructed for the peculiar conditions which exist between the New Siberian Islands and the Pole. Dr. Nansen will be accompanied by probably not more than eight young men, all as stalwart and strong in physique as himself, and all equally confident of success.

AT a meeting of the Royal Botanic Society of London on Saturday, a report by Mr. Lecky was read, giving a summary and digest of the sun record in the Gardens during the year 1890, showing the percentage of each month. As compared with the returns for the previous year, this shows an increase of 156 hours of bright sunshine, a result due to the latter half of the year (the earlier months being comparatively sunless). The total recorded for the year amounts to 1092 hours, as against a possible total of 4455 hours. A noticeable feature was the predominance of afternoon sunshine, due, it seems, to the position of the Gardens in the north-west of London, and the difficulty the sun has in piercing the smoke and mists from the eastern districts as it rises. Not the slightest trace of sunshine is recorded as having occurred during December.

A propos of the recent severe weather, *La Nature* has a representation of an ice colonnade, made near Rheims in January, which is about 14 feet high, and bends in half circle round an ice figure of Father Christmas. M. Caron describes a peculiar kind of ground ice found in rivers in the Jura region. In clear cold nights crystals form at the bottom, and rise in groups to the surface. They consist of small needles and lamellæ of ice held by mutual attraction, but not adherent to each other. They offer no resistance to boats or oars, but may sometimes cause much inconvenience : thus they accumulate and stop water-wheels ; or, rapidly collecting on a dam, they may cause flooding. M. Franger (an Alsatian engineer) points out that all circumstances unfavourable to radiation from a river bed, are also against formation of ground ice, which is rarely, if ever, met with in a stream that is muddy or too deep, so as not to transmit the heat-rays, or where the motion is sluggish enough for surface ice to form, and for gravel at the bottom to be covered with sediment. At the sluices near Maigrange, according to M. Cuony, ground ice forms about the iron work largely used in the sluices, and is got rid of by heating the upper part of the structure with wood fires. M. Cuony produced ground ice experimentally, by cooling an iron bar 10° to 15° below zero C., and plunging it in cold water ; thus illustrating the part played by the piles of bridges.

THE Report of the Smithsonian Institution for 1888 (Washington, 1890) contains *inter alia* a review by Prof. Cleveland Abbe on "Recent Progress in Dynamic Meteorology," giving a brief, but careful, summary of the most important works which have appeared up to December 1888, on the movements of storms and the general motions of the atmosphere. The works summarized are classified under the following heads : (1) laboratory experiments on fluid motion ; (2) statistics of actual storms ; (3) theoretical hydrodynamics applied to the motion of the air ; (4) thermodynamics of atmospheric phenomenon ; (5) prediction of storms and weather. The author considers that it is generally conceded that meteorological phenomena, at least those which depend on the motions of the atmosphere, are too difficult to be unravelled at present, although much progress has been made during the last few years. His summary will be a good guide for persons wishing to study the science.

THE Royal Meteorological Institute of the Netherlands has published a work upon the tides off the Dutch coast, based on the observations of the light-keepers on the various banks, showing graphically the average times of the turning of the tides, and also the means of sea temperature at and below the surface, deduced from hourly observations. The mean annual temperature of the air is slightly lower than the sea-surface temperature, but in some months the reverse occurs, and the temperature at depths of 5 and 10 fathoms differs very slightly from the sea-surface temperature. Tide rips are most frequent in April, during the first four days of full and new moon, while the least number occur in January. With a strong south-west wind, the tide runs eight miles an hour.

We learn from the *Oesterreichische botanische Zeitschrift* that Herr H. Leder has undertaken a three years' zoological and botanical expedition to Siberia. During the first year he proposes to visit the Tunka and Sajan mountains to the south of Irkutsk; in the second year he will follow the course of the On-on into Transbaikal; and during the third year he has planned a visit to the upper course of the Amur and Argun in the Katunsk Altais.

The editors of the *Botanisches Centralblatt*, finding it impossible to keep pace with the ever-increasing mass of botanical literature, have arranged for the publication of *Beihefte*, of which it is intended that seven, of eighty pages each, shall appear annually, with only a moderate increase in the annual subscription. By this means it is hoped that the delay which has hitherto occurred in the *résumés* of important botanical papers may in the future be avoided. The first of these supplements has appeared, and contains notices of several English papers which have appeared in the *Annals of Botany* and elsewhere.

Tea at £10 12*s*. 6*d*. per pound ought to have very special qualities. A small parcel of Ceylon tea, from the Gartmore Estate, was sold at this price at the London Commercial Tea Sale Rooms on Tuesday. The tea is composed almost entirely of small "golden tips," which are the extreme ends of the small succulent shoots of the plant.

The new number of the Journal of the Institution of Electrical Engineers (No. 91) contains the Presidential address on "Electricity in Transitu," delivered by Prof. Crookes on January 15. There are also papers on "Electric Lighting from Central Stations," by General Webber, and on the "Early History of the Telegraph in India," by Mr. P. V. Luke.

The use of oil at sea continues to be regarded by experienced masters of vessels as an excellent means of protection in stormy weather. A number of recent reports on the subject, printed in America, afford striking testimony to the efficacy of the method. Captain Rogers, Br. s.s. *Congo*, for instance, writes thus:—"Left Liverpool, January 18, 1891, for New York; arrived February 8. At 4 a.m., February 4, it was blowing a hurricane, ship taking some very heavy seas aboard. Put her before the wind, stopped the engines, and put an oil-bag out on each quarter. Ship rode out the hurricane splendidly, and without shipping any water whatever." Chief Officer Miller, Am. brig. *Marena*, writes:—"During the gale which began on January 10, lat. 32° 56′ N., long. 75° 20′ W., and ended on January 12, lat. 34° 40′ N., long. 74° 45′ W., wind from south to west-north-west, the vessel was hove-to and a hemp-canvas bag was partly filled with oakum, saturated with fish oil. The bag was replenished every two hours, and was allowed to just dip into the sea from the lee quarter. The oil was used for twenty-four hours, and as the vessel lay quite easy and shipped no heavy seas it proved a great success. The captain is always provided with a full supply of fish oil (which he considers the best), and all appliances for instant use." Captain Leseman, Br. s.s. *Miranda*, reports:—"Used oil with most excellent effect in the gale encountered on December 1, 1890, between St. John's and Halifax. The oil was a combination of kerosene and linseed, and was used from the closets forward and from bags on each side amidships. Waves would come bearing down in the direction of the steamer as though to crush her, but they no sooner reached the oil than they rolled harmlessly past. To its use we owe our lives and the safety of the ship."

Some interesting remarks on squirrels are made by various writers in the current number of the *Zoologist*. It is often said that squirrels are torpid during winter, but there is no really sound evidence for this view. Mr. Masefield, writing from Cheadle, Stafford, says:—"I have seen squirrels abroad on fine days in, I think I may say, every one of the winter months; and while pheasant-shooting near here on a sunny day (January 6 last), which was about the middle of the most severe frost we have had for many years, with several inches of snow on the ground, I saw a squirrel jumping from tree to tree, before the beaters, in the most lively condition." Mr. Blagg, also writing from Cheadle, has "frequently seen squirrels abroad in the middle of the winter, when there has been deep snow on the ground and a keen frost in the air." "I remember," he adds, "once seeing a squirrel abroad during a severe storm of sleet and rain in winter-time, and he appeared to be not at all inconvenienced by the rough weather." Mr. Blagg's idea is that the squirrel probably does sleep a good deal more in winter-time than in summer, as do many other wild animals, but that he has to be continually waking up and taking nourishment. The period of reproduction is unfavourable to the notion of an almost complete state of torpidity. The editor of the *Zoologist* records that he has notes of "finding newly-born squirrels on March 21 (three young), April 9 (three young), April 26 (four young), and April 29 (two young). Those found at the end of March and beginning of April were naked and blind; those taken at the end of April were about three parts grown." According to the editor, "the old squirrels, in case of danger, remove the young from the nest, or 'drey,' to some hole in a tree, whither they carry them one by one in the mouth, just as a cat carries her kitten. One of the prettiest sights in the world is to see an old squirrel teaching a young one to jump."

It has been recently shown by Dr. Marcet (*Arch. des Sciences*) that different persons respire different volumes of air to furnish to the body the oxygen required, and to yield a given weight of carbonic acid. Thus, to produce one gramme of carbonic acid, three persons were found to need, on an average, 9·29, 10·51, and 11·30 litres of air respectively. The first was 23 years of age, the third 60; and no doubt the less the air required for a given combustion, the better the conditions of respiration. The influence of food on formation of carbonic acid in the body begins in the first hour after a meal, and increases for two or three hours, the period of maximum respiration of CO_2 varying in this time. After a certain time, the weight of CO_2 expired decreases more rapidly than the required volumes of air decrease. The influence of local variations of air-pressure appears in less air being needed, for a given amount of CO_2, with low pressures than with high; but the degree of the influence varies in individuals.

As it is possible that circumstances may arise during the next few years which may make it desirable to lay down a cable to the Andamans, the Meteorological Reporter to the Government of India has, according to the Indian press, recorded his opinion that it is almost absolutely necessary for the warning of the Bengal and Madras coasts that such a cable should be laid, and that he believes it to be almost essential to the proper and complete protection of the Burmah coast. Observations from Port Blair would rarely give earlier information of the commencement of disturbed weather in the Bay than is shown by the present battery of stations round the Bay. They would, however, in the majority of cases, give earlier definite information as to the storm in process of formation, whether it was a feeble or powerful one, or of small or large extent. They would also enable the probable path of the storm to be determined with greater certainty than can be done under the present arrangements. Telegraphic communication to Port Blair would hence tend to make the work of storm-warning more exact and trustworthy, and enable the Meteorological Department to state with greater certainty than at present the probable path or intensity of storms approaching the Bengal and Madras coasts. It would also give certain and strong indications of the formation of storms in the Andaman Sea, and enable the Department to warn the Burmah coast more efficiently than at present.

PROF. DUBOIS, of Berne, has been lately studying the physiological action of electric currents and discharges (*Arch. des Sciences*); and he has some interesting observations on the human eye, which, it is known, has luminous sensations under the action of galvanic currents. Sudden variations of intensity, especially at making and breaking the circuit, produce such flashes. With a moistened plate at the nape of the neck, and a pad on the eye, a slight flash was distinctly perceived even with a Leclanché cell of about 1·20 volt, and measuring in the galvanometer 4/100 of a milliampere. Raising the intensity to five-tenths, the observer could tell which pole was applied to the eye. On the other hand, the retina responds much less readily to discharges from condensers or induction coils. Not till a capacity of 0·037 microfarad and a tension of 21 volts was reached, was a true retinal flash perceived; and not even with 10 microfarads were the durable sensations characteristic of the two poles produced. The retina reacts to quantity.

AN important new mineral, titanate of manganese, $MnTiO_3$, isomorphous with the well-known titanate of iron or titanic iron ore, $FeTiO_3$, has been discovered in the neighbourhood of Harstigen by Dr. Hamberg, and is described by him in the current number of the *Geol. Foeren. i. Stockholm* (12 Band, 598). The crystals were found embedded in calcite, and were readily isolated by removing the latter by means of dilute hydrochloric acid, the titanate of manganese being but very slightly attacked by acids. They were of tabular habitus, and possessed an exceptionally brilliant metallic lustre of a deep red tint. In thin sections the colour is seen to be orange-red, and is not pleochroic. When ground to powder a yellow ochre is produced, possessing a slight tinge of green. The crystals are as hard as apatite, and have a specific gravity of 4·537. They consist of almost pure manganous titanate, containing 50·49 per cent. of titanium dioxide and 46·92 per cent. of manganous oxide. Like titanic iron ore, the crystals belong to the rhombohedral-hexagonal system, the basal plane (0001) being the principal face, upon which the crystals are tabular. The edges of the tables exhibit faces of the negative rhombohedron $(02\bar{2}1)$, and the deuteroprism $(11\bar{2}0)$. The angle of the rhombohedron is very near that of titanic iron ore, and if the ratios of the axes of the two compounds are compared the similarity is very striking indeed. In the case of titanate of iron $a : c = 1 : 1{\cdot}385$, and in the new mineral $a : c = 1 : 1{\cdot}369$. Indeed, the isomorphism is even more complete, for titanic iron ore is not only rhombohedral, but is also tetartohedral; and a study of the corrosion figures produced by boiling hydrochloric acid upon the basal plane of titanate of manganese shows that this mineral is likewise tetartohedral. The optical properties of the new mineral are also rather remarkable. The refractive index of the ordinary ray for sodium light is no less than 2·4810, almost as high as the refractive index of the diamond, for the extraordinary ray somewhat less, 2·21. The dispersion is likewise large, the respective indices for the lithium red and thallium green rays being 2·44 and 2·54 respectively. The crystals cleave readily parallel to the rhombohedral and prism faces. Dr. Hamberg gives the name pyrophanite to the mineral. He is of opinion that specular iron ore, hæmatite, Fe_2O_3, which he writes $FeFeO_3$, is also truly isomorphous with pyrophanite, and this assumption is certainly supported by the similarity of the axial ratios, those of hæmatite being $a : c = 1 : 1{\cdot}359$. The ruby and sapphire, Al_2O_3, may perhaps also be included in the series, for their axial ratios are almost identical with those of pyrophanite, $a : c = 1 : 1{\cdot}363$. Hæmatite, crystallized alumina, pyrophanite, and titanic iron ore, would thus form an isomorphous series with gradually ascending axial ratios.

THE additions to the Zoological Society's Gardens during the past week include a Serval (*Felis serval* ♀) from East Africa, presented by Mr. D. Wilson; two Red-backed Weaver Birds (*Quelea sanguinirostris*) from West Africa, presented by Mrs. Hastings; a White Frog (*Rana temporaria*, var.), British, presented by Mr. W. Hannaford; a Rhesus Monkey (*Macacus rhesus* ♂) from India, a West African Python (*Python sebæ*) from West Africa, deposited; a Snow Leopard (*Felis uncia*) from the Himalayas, a Collared Peccary (*Dicotyles tajaçu* ♀) from South America, two North American Turkeys (*Meleagris gallo-pavo* ♂ ♀) from North America, six Shore Larks (*Otocorys alpestris*), British, purchased; a Yellow-footed Rock Kangaroo (*Petrogale xanthopus* ♂), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

PHOTOGRAPHIC SPECTRUM OF THE SUN AND ELEMENTS.—The *Johns Hopkins University Circular*, No. 85, issued last month, contains Prof. Rowland's report of progress in spectrum work. The spectra of all known elements, with the exception of a few gaseous ones, or those too rare to be yet obtained, have been photographed in connection with the solar spectrum, from the extreme ultra-violet down to the D line, and eye-observations have been made on many to the limit of the solar spectrum. A table of standard wave-lengths of the impurities in the carbon poles extending to wave-length 2000, has been constructed to measure wave-lengths beyond the limits of the solar spectrum. In addition to this, maps of the spectra of some of the elements have been drawn up on a large scale, ready for publication, and the greater part of the lines in the map of the solar spectrum have been identified. The following rough table of the solar elements has been constructed entirely according to Prof. Rowland's own observations, although, of course, most of them have been given by others :—

Elements in the Sun, arranged according to Intensity and the Number of Lines in the Solar Spectrum.

According to intensity.		According to number.	
Calcium	Zirconium	Iron (2000 or more)	Magnesium (20 or more)
Iron	Molybdenum	Nickel	Sodium (11)
Hydrogen	Lanthanum	Titanium	Silicon
Sodium	Niobium	Manganese	Strontium
Nickel	Palladium	Chromium	Barium
Magnesium	Neodymium	Cobalt	Aluminium (4)
Cobalt	Copper	Carbon (200 or more)	Cadmium
Silicon	Zinc	Vanadium	Rhodium
Aluminium	Cadmium	Zirconium	Erbium
Titanium	Cerium	Cerium	Zinc
Chromium	Glucinum	Calcium (75 or more)	Copper (2)
Manganese	Germanium	Scandium	Silver (2)
Strontium	Rhodium	Neodymium	Glucinum (2)
Vanadium	Silver	Lanthanum	Germanium
Barium	Tin	Yttrium	Tin
Carbon	Lead	Niobium	Lead (1)
Scandium	Erbium	Molybdenum	Potassium (1)
Yttrium	Potassium	Palladium	

Doubtful Elements.

Iridium, Osmium, Platinum, Ruthenium, Tantalum, Thorium, Tungsten, Uranium.

Not in Solar Spectrum.

Antimony, Arsenic, Bismuth, Boron, Nitrogen, Cæsium, Gold, Indium, Mercury, Phosphorus, Rubidium, Selenium, Sulphur, Thallium, Praseodymium.

With respect to these tables Prof. Rowland adds :—"The substances under the head of 'Not in the Solar Spectrum,' are often placed there because the elements have few strong lines or none at all in the limit of the solar spectrum when the arc spectrum, which I have used, is employed. Thus boron has